**Grade 7 Investigation: Adding and Subtracting Integers.**

In this investigation you are going to consider a new set of numbers and discover the rules that apply to them when adding and subtracting. This investigation will be assessed against criterion B.

**Sets of numbers:**

The numbers 1, 2, 3, 4, …. are called **natural** numbers (the counting numbers) . This set of numbers can be represented by the symbol ***N*** and can be written in the following set notation .

The numbers 0, 1, 2, 3, 4, …. are called **whole** numbers. This set of numbers can be represented by the symbol ***W*** and can written in the following set notation .

These numbers are shown on the number line below:



If we extend the number line to the left we get;



This larger set of numbers is called **integers**. The number 1, 2, 3, 4, …. are ***positive integers*** and the numbers ….,-4, -3, -2, -1 are ***negative integers*** . The number 0 is neither positive nor negative, but is still an integer.

This set can be written using the symbol ***Z*** and can be written in the following set notation.



**Part 1: Adding integers**

Representing number sentences on a number line.

**Example 1:** Represent the **number sentence** 3 + 2 = 5:

# Macintosh HD:Users:renee:Desktop:Picture 2.png

# 

+3 +2

Start at 0, move 3 units to the **right** for +3 and then to show addition 2, move 2 more units to the **right**. You end up at 5. 3 + 2 = 5

**Example 2:** Let’s try adding a negative integer. 

# Macintosh HD:Users:renee:Desktop:Picture 2.png

# +-2 -3

Start at 0, move 3 units to the **left (negative direction)** for -3 and then to show addition

-2, move 2 more units to the **left**. You end up at -5. 

**Example 3:** Let’s try adding a negative integer and a positive integer on the number line.

# Macintosh HD:Users:renee:Desktop:Picture 2.png

# ++2

# -3

Start at 0, move 3 units to the **left (negative direction)** for -3 and then to show addition 2, move 2 more units to the **right**. You end up at -1. 

**Question 1:** Illustrate each addition problem on the number lines below and give an answer:

a) 



**Answer:** \_\_\_\_\_\_\_\_\_\_

b) 

**Answer:** \_\_\_\_\_\_\_\_\_\_\_

c) 1+3

**Answer:** \_\_\_\_\_\_\_\_\_\_\_\_

d) Finish the following sentence:

When I add two positive numbers I always get \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

e) Explain in your own words why this happens and use two examples to help support your answer.

**Question 2.** Illustrate each addition problem on the number lines below and give an answer.

a) 



**Answer:** \_\_\_\_\_\_\_\_\_\_\_

b) 

**Answer:** \_\_\_\_\_\_\_\_\_\_\_

c) 

**Answer:** \_\_\_\_\_\_\_\_\_\_\_\_

d) Finish the following sentence:

When I add two negative numbers I always get \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

e) Explain in your own words why this happens and give two examples to help support your answer.

**Question 3.** Illustrate each addition problem on the number lines below and give an answer.

a) 



**Answer:** \_\_\_\_\_\_\_\_\_\_\_\_

b) 

**Answer:** \_\_\_\_\_\_\_\_\_\_\_\_

c) 

**Answer:** \_\_\_\_\_\_\_\_\_\_\_\_

d) 

**Answer:** \_\_\_\_\_\_\_\_\_\_\_\_

e) Explain what happens when you add a positive and a negative number together. Think carefully and use four examples to support your answer.

f)Summarising the patterns you found in **part A** for adding integers. The following table may help you organize what you found.

**NOTE: (+ive) stands for positive integer and (-ive) stands for negative integer.**

|  |  |
| --- | --- |
| **Adding** | Patterns I noticed. |
| **(+ive) +(+ive)** |  |
| **(-ive)+(-ive)** |  |
| **(+ive)+(-ive)** |  |

**Part B: Subtracting and adding integers.**

Representing subtraction on a number line

**Example 1:** Represent the **number sentence** 

# Macintosh HD:Users:renee:Desktop:Picture 2.png

# -+2

# +3

Start at 0, move 3 units to the **right** for +3 and then to show subtraction 2, move 2 more units to the **left ie the opposite direction to add 2** You end up at 1.



**Question 1:** Illustrate each problem on the number lines below and give an answer:

a) 



**Answer:** \_\_\_\_\_\_\_\_\_\_\_\_\_

b) 

Answer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

c) 

Answer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

d) 

Answer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

e) What did you notice about the answers to the pairs a), c) and b), d)

f) What did you notice about the direction (+-) and (-+) sends you to go on the number line?

g) Is this a negative direction or a positive direction?

h) Could you write (+-) and (-+) as one sign?

**Example 2:** Let’s try subtracting a negative integer. 

# Macintosh HD:Users:renee:Desktop:Picture 2.png

# --2

-3

Start at 0, move 3 units to the **left (negative direction)** for -3 and then you must subtract -2, to add -2 your would go **left** therefore to add -2 you must go **right** move 2 more units to the **right**. You end up at -1. 

**Question 2:** Illustrate each problem on the number lines below and give an answer:

a) 



**Answer:** \_\_\_\_\_\_\_\_\_\_\_\_

b) 

**Answer:** \_\_\_\_\_\_\_\_\_\_\_\_\_

c) 

**Answer:** \_\_\_\_\_\_\_\_\_\_\_\_\_

d) 

**Answer:** \_\_\_\_\_\_\_\_\_\_\_\_\_

e) What did you notice about the answers to the pairs a), b) and c), d)?

f) What did you notice about the direction (++) and (--) sends you to go on the number line?

g) Is this a negative direction or a positive direction?

h) Could you write (++) and (--) as one sign?

i) Summarising the patterns you found in **part B** for adding and subtracting integers. The following table may help you organize what you found.

|  |  |
| --- | --- |
| **Two signs** | **One sign** |
| **(++)** |  |
| **(- -)** |  |
| **(+ -)** |  |
| **(- +)** |  |

j) Fill in the sentence from the pattern in your table:

When two signs are like: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

When two signs are unlike: \_\_\_\_\_\_\_\_\_\_\_\_\_

**Part C:** Using what you have found out about two signs converting to one in **part B** rewrite the following number sentences and then solve on the number line.

Remember **addition** means go right and **subtraction** means go left.

1.  Rewrite number sentence with one sign:\_\_\_\_\_\_\_\_\_\_\_\_



Answer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

2.  Rewrite number sentence with one sign:\_\_\_\_\_\_\_\_\_\_\_\_



Answer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

3.  Rewrite number sentence with one sign:\_\_\_\_\_\_\_\_\_\_\_\_



Answer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

4.  Rewrite number sentence with one sign:\_\_\_\_\_\_\_\_\_\_\_\_



Answer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Criterion B: Investigating Patterns**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Level | **Level Descriptors** | **Task Specific Indicators** |
| ***Criterion B* Patterns** | **0** | **You have failed to submit work or have submitted work that does not reach any of the standards described below.** | * Task not submitted. |
| **1-2** | The student **applies, with some guidance**, mathematical problem-solving techniques to recognize **simple** patterns. | * You have tried to complete the number lines. * You have tried to use your mathematical knowledge to recognize a pattern when looking at your number lines |
| **3-4** | The student **selects and applies** mathematical problem-solving techniques to recognize patterns, and **suggests** relationships or general rules. | * You have been generally successful completing your number lines * You have tried to suggest some relationships or rules for the simple patterns you have recognized. |
| **5-6** | The student **selects and applies** mathematical problem-solving techniques to recognize patterns, **describes** them as relationships or general rules, and **draws conclusions** consistent with findings. | * You have successfully completed your number lines. * You have described a majority of the patterns you saw as relationships or general rules. * You have been able to complete most of **part C** correctly. |
| **7-8** | The student **selects and applies** mathematical problem-solving techniques to recognize patterns, **describes** them as relationships or general rules, **draws conclusions** consistent with findings, and **provides justifications or proofs**. | * You have successfully completed your number lines. * You have described the patterns you saw as relationships or general rules. * You have successfully completed all of **part C.** * You have clearly explained why your rules or relationships make sense and used examples to support. |